CLAIMS

What is Claimed Is:

1.   A method of building and maintaining an object-oriented database from a

5   vector product format (VPF) database, comprising:

instantiating objects of the object-oriented database, using the VPF database;

initializing spatial and non-spatial feature data of the object-oriented database;

spatially indexing data among objects across hierarchical levels of the object-

oriented database;

10   updating data of the object-oriented database; and

exporting the contents of the updated object-oriented database to the VPF

database.

2.   A method of building and maintaining an object-oriented spatial database

15   from at least two of a vector product format (VPF) database, a raster product format (RPF)

database, and a text product standard (TPS) database, comprising:

instantiating objects of the object-oriented database, using at least two of the

VPF, RPF, and TPS databases;

initializing spatial and non-spatial feature data of the object-oriented database;

20   and

spatially indexing data among objects from the at least two VPF, RPF, and

TPS databases into the single, object-oriented spatial database.

3.   A method of building and maintaining an object-oriented database from a

25   vector product format (VPF) database, comprising:

instantiating objects of the object-oriented database, using the VPF database;

initializing spatial and non-spatial feature data of the object-oriented database;

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spatially indexing data among objects across hierarchical levels of the object-oriented database; and

updating spatial and non-spatial data.

5   4.   The method according to claim 3, wherein the step of initializing spatial and non-spatial feature data creates a feature level having:

non-spatial data which provides characteristic properties of each feature;

spatial data, including primitive data and topological information, which provides spatial relationships between a feature object and other feature objects within a

10   specified coverage; and

wherein related non-spatial and spatial data are directly accessible from the feature object.

5.   The method according to claim 4, wherein the step of updating spatial and

15   non-spatial data includes adding, changing, and deleting feature, primitive, and topological data within the database and further includes updating all object links referencing the feature, primitive, and topological data.

6.   The method according to claim 3, wherein the step of spatially indexing data

20   is applied to one or more databases whose format comprises:

a flat file;

a raster product format;

a vector product format; and

a text format.

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7.   The method according to claim 6, further comprising a step of retrieving data objects matching a user-specified query based on at least one of the following data

characteristics:

        feature attributes;

        geometrical constraints;

        topological constraints; and

5   geographical constraints.

        8.   The method according to claim 7, wherein the step of retrieving data objects includes:

        a flat file;

10   a raster image;

        a VPF feature; and

        text data.

        9.   A method of building and maintaining a database, comprising:

15   creating an object-oriented database from a relational geospatial database with feature objects having non-spatial data, which provides characteristic properties of each feature, and spatial data, including primitive data and topological information, which provide spatial relationships between a feature object and other feature objects within a specified coverage, wherein related non-spatial and spatial data are directly accessible from the feature

20 object.

        10.   A method of searching an object-oriented hierarchical database of spatial data, comprising:

        listing all databases containing feature data of a user-selected spatial point of

25 interest;

        listing all libraries, within a user-selected database from the list of databases, containing data intersecting the user-selected spatial point of interest;

listing coverages and features, within a user-specified library from the list of

libraries; and

listing objects from the user-selected database that satisfy a user-selected point

of interest and user-selected coverages and/or features, wherein the listed objects include:

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a flat file;

a raster image;

a VPF feature; and

text data.

10   11.   The method according to claim 10 wherein the step of listing objects further

includes the step of searching the object-oriented hierarchical database by one or more of the

following data characteristics:

feature attributes;

geometrical constraints;

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topological constraints; and

geographical constraints.

12.   A computer readable medium encoded with software to build and maintain an

object-oriented, hierarchical database from a vector product format (VPF) database.

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13.   A computer system comprising:

a storage medium storing an object-oriented hierarchical database based on a

VPF database;

a processor spatially indexing data among objects across hierarchical levels of

25   the object-oriented hierarchical database;

a processor searching the object-oriented hierarchical database in response to a

user-specified query; and

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a graphical user interface for accepting the user-specified query and for displaying the results of the object-oriented database search.

14.   A computer program embodied on a computer-readable medium to access an

5   object-oriented spatial database, comprising:

a construction code section to build a hierarchy of spatial data, including the levels of library, coverage, and feature data;

an addition code section to add data associated with one or more of the hierarchical levels;

10   an indexing code section to spatially index data among objects across hierarchical levels of the object-oriented database;

a change code section to update data associated with one or more of the hierarchical levels; and

a query code section to search the object-oriented database for user-specified

15   features and to view the search results.

15.   A four-dimensional data structure embodied on a computer-readable medium for building and maintaining an object-oriented spatial database, comprising:

the four-dimensional data structure being structured according to database,

20   library, object, and primitive levels;

the data at each level being spatially indexed to the data above and below each said level; and

the data within the object-oriented spatial database being exported to a relational database in vector product format (VPF).

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16.   An apparatus for building and maintaining an object-oriented hierarchical database of spatial data, comprising:

a processor spatially indexing objects across hierarchical levels of the object-oriented database such that the spatial data is linked to objects located at levels higher and lower than itself;

a storage device on a computer-readable medium on which is stored the

5   object-oriented hierarchical database;

a processor updating the spatial data such that the data shared among features is retained; and

an output device displaying to a user results of a user-specified query of the object-oriented hierarchical database.

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17.   An apparatus for building and maintaining an object-oriented hierarchical database of spatial data, comprising:

processor means for transforming data into a linked hierarchical structure;

storage means for storing spatially-linked hierarchical data on a computer-

15   readable medium;

input means for entering update data for the object-oriented hierarchical database;

input means for entering database query instructions;

processor means for selecting object-oriented database objects and features

20   that satisfy the database query; and

output means for displaying the object-oriented database objects and features that satisfy the database query.